PhytoKeys 132: 11–18 (2019)
doi: 10.3897/phytokeys.132.36717
http://phytokeys.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
PhytoKeys
Launched to accelerate biodiversity research

Primulina serrulata (Gesneriaceae), a new species from southeastern Guizhou, China

Hong Jiang[1], Tan Deng[1], Xin-Yun Lv[1], Ren-Bo Zhang[1], Fang Wen[2,3,4]

1 *Department of Biology, Zunyi Normal College, Zunyi, Guizhou 563002, China* **2** *Guangxi Key Laboratory of Plant Conservation and Restoration Ecology in Karst Terrain, Guilin Botanical Garden, Guangxi Institute of Botany, Guangxi Zhuangzu Autonomous Region and Chinese Academy of Sciences, Guilin 541006, China* **3** *Gesneriad Conservation Center of China, Guilin Botanical Garden, Chinese Academy of Sciences, Guilin 541006, China* **4** *Key Laboratory of Plant Resources Conservation and Sustainable Utilization, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China*

Corresponding author: *Fang Wen* (wenfang760608@139.com)

Academic editor: *E. Fischer* | Received 3 June 2019 | Accepted 30 August 2019 | Published 19 September 2019

Citation: Jiang H, Deng T, Lv X-X, Zhang R-B, Wen F (2019) *Primulina serrulata* (Gesneriaceae), a new species from southeastern Guizhou, China. PhytoKeys 132: 11–18. https://doi.org/10.3897/phytokeys.132.36717

Abstract

Primulina serrulata R.B.Zhang & F. Wen, a new species from a limestone area in southeastern Guizhou, China, is described and illustrated here. The new species is morphologically related to *P. fimbrisepala* (Hand.-Mazz.) Y.Z.Wang. We examined the morphological differences between these congeners and provide illustrations and photographs of this new species in this paper.

Keywords

Flora of Guizhou, Karst region, New taxa, *Primulina fimbrisepala*

Introduction

The formerly monotypic genus, *Primulina* Hance, has become the largest genus in the subfamily *Didymocarpoideae* of Gesneriaceae in China (Weber et al. 2013, Xu et al. 2017, Wen et al. 2019). The number of *Primulina* has been growing explosively since 2005 (Möller et al. 2016, Möller 2019). For the moment, there are a total of 199 species (including infraspecies) in this genus in China (Wen et al. 2019). *Primulina* shows high levels of endemism and ecological (edaphic) specialization, especially in Karst areas.

Copyright *Hong Jiang et al.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Based on extensive literature surveys and field observations, we discovered that most species of *Primulina* occur in the karst area of southern and southwestern China and northern Vietnam. They are often limited to a single or a few caves or in specialized and narrow microhabitats of karst limestone hill systems, called island distributions (Wang et al. 1998, Li and Wang 2004, Wei et al. 2010, Hao et al. 2015). The current research result indicated that geographical isolation had been demonstrated to be one kind of reliable driver of *Primulina* diversification and speciation, for example, *P. eburnea* and *P. hochiensis* complexes (Gao et al. 2015, Wang et al. 2017, Yang et al. 2019).

In 2018, during field explorations, a local herbalist found an unknown species of *Primulina* near the Guizhou-Guangxi border at Rongjiang County, southeastern Guizhou, China (Figure 1). Several living individuals from the population found in the field were brought to the nursery of Gesneriad Conservation Center of China (GCCC) and cultivated there. The leaf blade margin characteristics of these plants look appealing because of the prominent and irregular serrations. At the same time, the beautiful silvery veins on the leaf blades and purplish-blue flowers soon caught our attention. However, this species can easily be distinguished from its congener by its morphology. After a morphological comparison between this new species and its related species and literature studies, we consider it is new to science, which is being described and illustrated here.

Methods

Morphological observations of the new species were carried out based on living plants as well as dry specimens. All morphological characters were measured with dissecting microscopes and were described using the terminology presented by Wang et al. (1998). Literature studies included all relevant monographs, i.e., Wang et al. (1998), Li and Wang (2004) and Wei et al. (2010), and also some recently published literature. Specimen checking was done at IBK, IBSC, PE and also some web databases, such as Chinese Virtual Herbarium (http://www.cvh.ac.cn/) and Global Plants (http://plants.jstor.org/).

Taxonomy

Primulina serrulata **R.B.Zhang & F.Wen, sp. nov.**
urn:lsid:ipni.org:names:77201948-1
Figures 1–3

Diagnosis. *Primulina serrulata* mainly differs from its congener, *P. fimbrisepala*, by its purplish-blue flowers which lack the dark purple spots inside the corolla (*vs.* purple to purplish-pink, with bright dark purple spots inside the corolla), cuneate leaf blade base (*vs.* obliquely cuneate, broadly cuneate or cordate), anthers glabrescent (*vs.* sparsely bearded) and smaller stigma ca. 1 mm long (*vs.* 2–3 mm long).

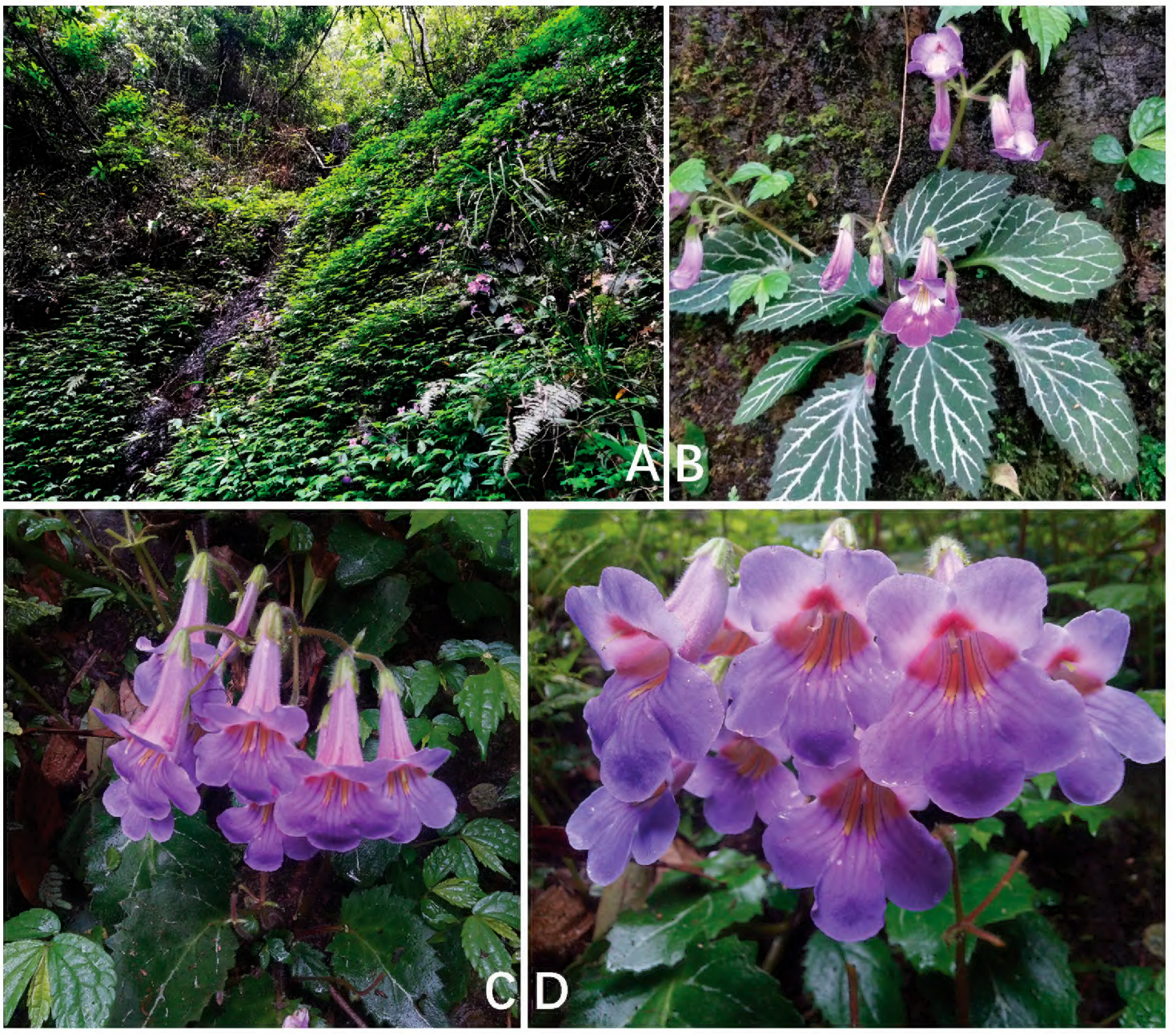

Figure 1. *Primulina serrulata*. **A** natural habitat **B** habit in flowering **C** cyme and flower in top view **D** flowers in front view. Charted by Wen-Hua Xu.

Type. CHINA. Guizhou Province, Rongjiang County, Langdong town, growing on moist limestone rocks surfaces near waterfall, alt. 780 m, 26°07'N, 108°42'E, 17 April 2018 (flowering), *Ren-Bo Zhang et al.*, *ZRB1478* (holotype: ZY!; isotype: IBK!).

Description. ***Rhizomatous*** stem subterete, ca. 6 cm long, ca. 1.5 cm in diameter. **Leaves** 4–6, all basal, opposite decussate. ***Petioles*** flatted, fragile and easy to be broken, 2–7 cm long, 4–5 mm wide, densely erect white multicellular hispid, hairs ca. 7 mm long. ***Leaf blade*** slightly fleshy and fragile when fresh, chartaceous when dried, obliquely ovate, oval to nearly rounded, 5–13 × 3–10 cm, densely erect white multicellular hispid and short hispid on both surfaces, base obliquely broadly cuneate, cordate to nearly rounded, margin conspicuously big and irregular serrate and biserrate; ***lateral veins*** 3–5 on each side, adaxially inconspicuously sunk but clearly slivery, occasionally green, abaxially conspicuously raised. ***Cymes*** 1–6, axillary, 1–2 branched, 2–5(8)-flowered; ***peduncles*** 11–16 cm long, ca. 2 mm in diameter, densely erect white multicellular hispid and short hispid; ***bracts*** 2, green, opposite, narrowly rhombic, 5–12 × 2–5 mm, margin inconspicuously serrate, apex acute, outside densely pubes-

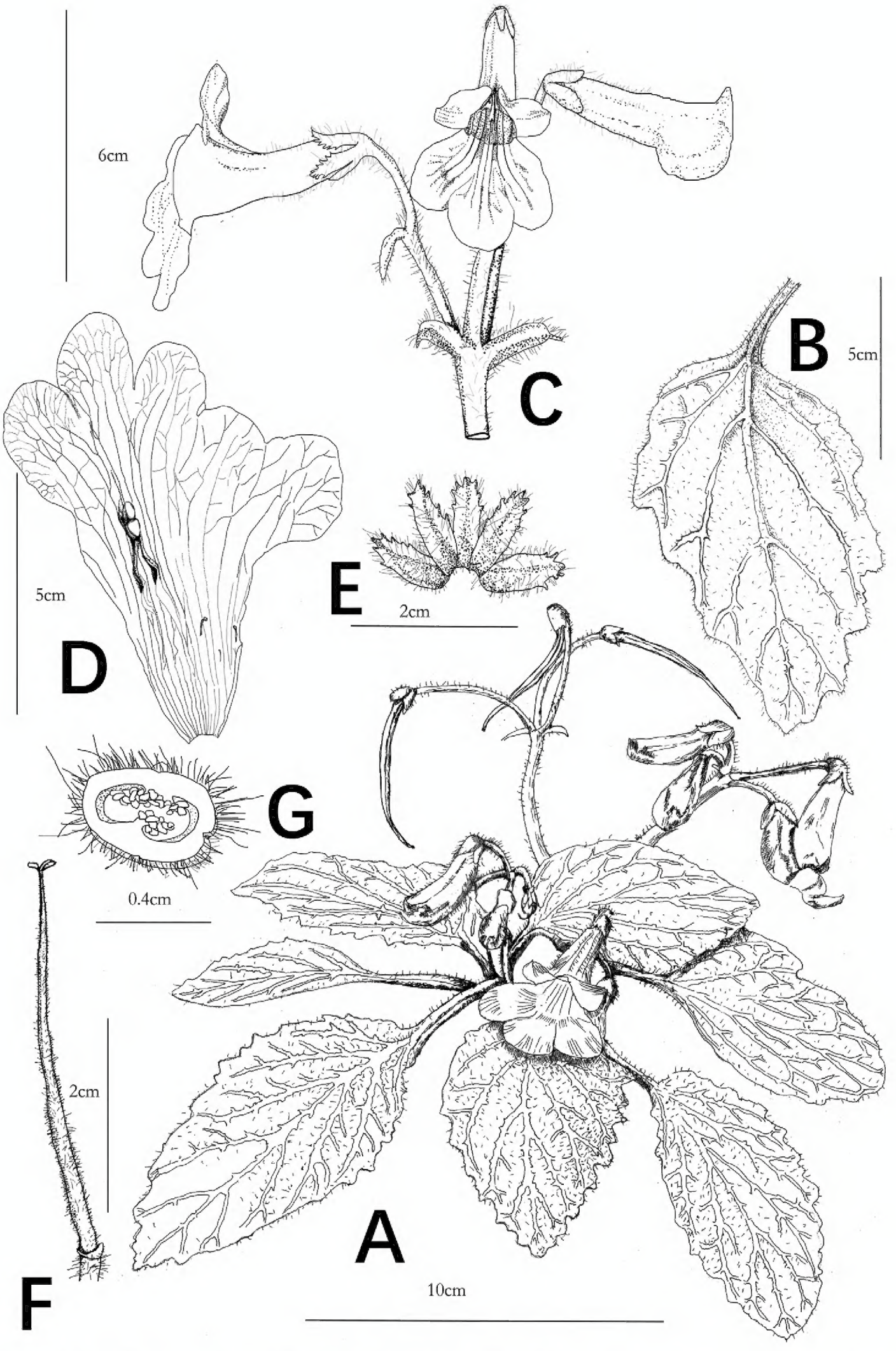

Figure 2. *Primulina serrulata*. **A** habit **B** adaxial leaf blade **C** cyme, bracts, flower in frontal view and flower in lateral view **D** opened corolla for showing stamens and staminodes **E** adaxial calyx lobes **F** pistil **G** cross section of ovary. Drawn by Tan Deng.

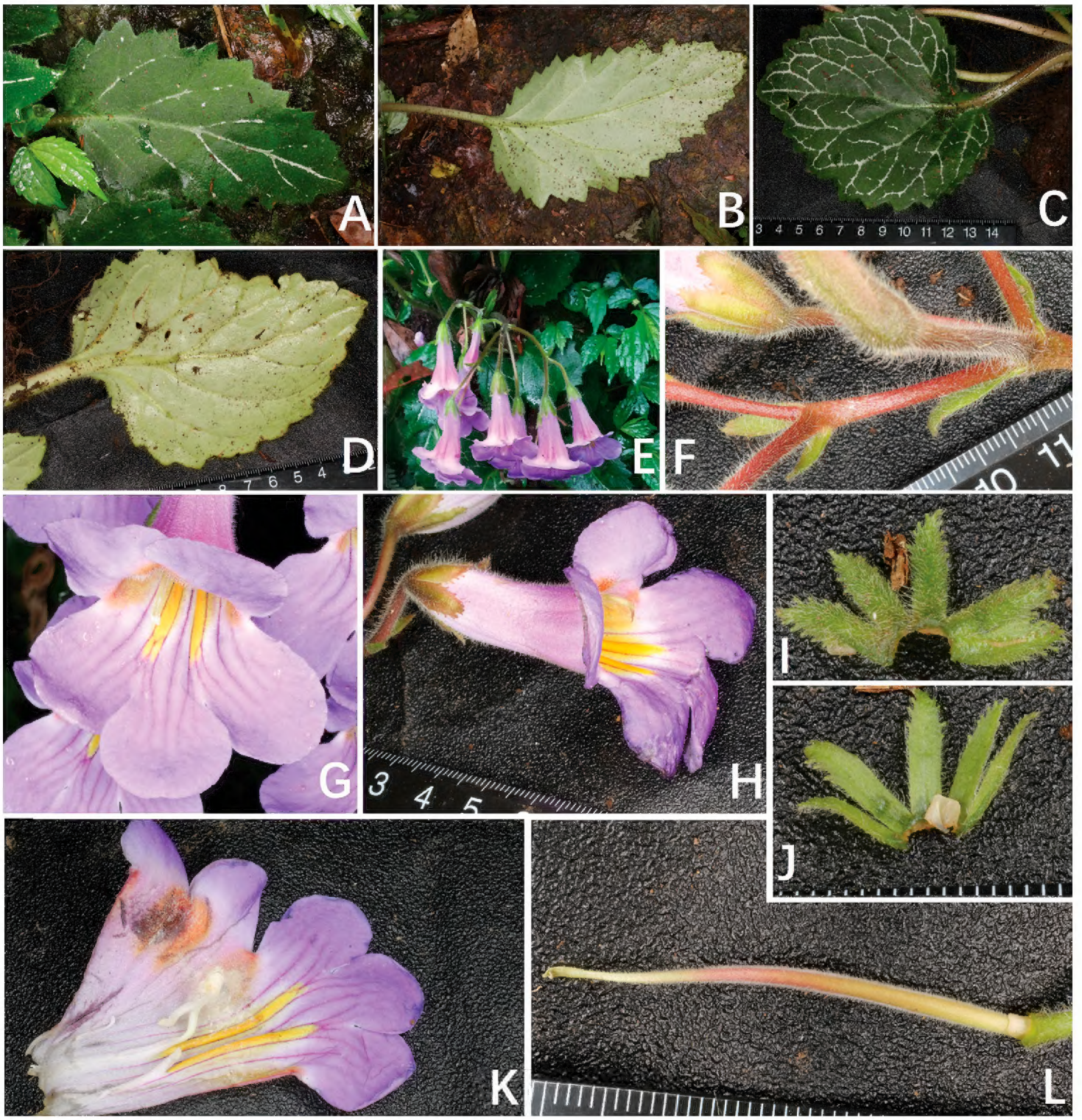

Figure 3. *Primulina serrulata*. **A, C** different shapes of adaxial leaf blades **B, D** different shapes of abaxial leaf blades **E** cyme, bracts, flower in top view **F** bracts and bracteoles **G** corolla in frontal view **H** corolla in lateral view **I** adaxial calyx lobes **J** abaxial calyx lobes **K** opened corolla **L** pistil. Charted by Wen-Hua Xu.

cent, inside pubescent; sometimes with bracteoles, opposite, 2, narrowly triangle, ca. 5 × 1 mm. ***Pedicel*** 2.5–5.5 cm long, ca. 1 mm in diameter, densely pubescent. ***Calyx*** 5-parted to near base, lobes oblong to lanceolate, green, 8–15 × 3–5 mm, outside densely pubescent, inside glabrous, apex subacute, margin entire about 2/3 of calyx lobe from the base but denticulate 3–4(5) about 1/3 of calyx lobe from the apex. ***Corolla*** pale purple to purple, the color of the throat same as corolla with two longitudinal yellow stripes along corolla tube but without dark purple spots, 4.5–6.0 cm long, outside glandular-pubescent and puberulent from the base to middle of corolla tube, inside glabrous; ***tube*** infundibuliform-tubular, 3.0–3.5 cm long, 1.0–1.5 cm in diameter at mouth, ca. 4 mm in diameter at base; ***limb*** distinctly 2-lipped, adaxial lip

2-parted, the upper part of the interior of two adaxial lip lobes with two lines of glandular hairs on the brown patch, lobes broadly ovate, 8–12 × 5–9 mm, apex rounded, abaxial lip 3-lobed, lobes oblong, 2.0–2.8 × 1.0–1.4 cm, apex rounded. ***Stamens*** 2, adnate to 10–13 mm above the corolla tube base; ***filaments*** linear, ca. 15 mm long, white, geniculate near the base, sparely puberulent from the middle to the top, the rest glabrous; ***anthers*** fused by the entire adaxial surfaces, ca. 4 mm long, glabrous. ***Staminodes*** 3, lateral ones 6–7 mm long, adnate to 12–15 mm above the corolla tube base, middle one ca. 1.5 mm long, adnate to 8–10 mm above the corolla tube base. ***Disc*** annular, the higher side ca. 1.5 mm in height but the lower side ca.0.8 mm in height. ***Pistil*** 3.5–4.5 cm long; ***ovary*** cylindrical, 2.5–3.2 cm long, densely glandular pubescent and puberulent; ***style*** 1–1.3 cm long, densely glandular-pubescent and puberulent; ***stigma*** obtrapezoid, apex 2-lobed, ca. 1 mm long, ca. 0.8 mm wide. ***Capsule*** linear, ca. 6 cm long, sparsely pubescent.

Distribution and habitat. At this time, *Primulina serrulata* is only known from the type locality in Langdong village, Langdong town, Rongjiang County, Guizhou Province, based on our field investigations. It grows on moist, shady, limestone rocks near a waterfall, at ca. 780 m altitude, with no more than 150 mature individuals. The population is close to a road, which makes it vulnerable and subject to destruction from human activities.

Phenology. This new species was observed flowering in April and fruiting from May to June.

Etymology. The specific epithet is derived from its particular leaf blade margin, having obvious serrations and bi-serrations.

Provisional IUCN conservation assessment. Because of *Primulina serrulata*'s beautiful leaves and flowers, it is being over-harvested by local people for sale. This unpublished species is therefore on the brink of extinction as a result. Before more surveys are completed to clarify its conservation status, the provisional conservation status is Critically Endangered CR B2ab (iii, v) according to the IUCN red list criteria (IUCN 2012).

Note. *Primulina serrulata* is related to its congener, *P. fimbrisepala*, by some characteristics, for example, the similar calyx lobes and infundibuliform corolla tube, but they can easily be distinguished from each other by the characters summarized in the description below. Numerous dark purple spots were covered at the throat of the corolla, and this is one stably distinctive feature of *P. fimbrisepala*. It is noticeable in different populations of *P. fimbrisepala* from South China when they are flowering (Figure 4). Table 1 below has more detailed information on how to distinguish the two species. They also grow in different substrates. *P. serrulata* only grows in limestone areas, while *P. fimbrisepala* commonly appears in weakly acidic mediums and soils of sandstone or granite mountainous regions. The different growing habitats of the two congeners indicate that geographical isolation should be one of the reliable drivers pushing this genus, *Primulina*, to generate diversification and speciation (Gao et al. 2015, Kong et al. 2017, Wang et al. 2017, Yang et al. 2019).

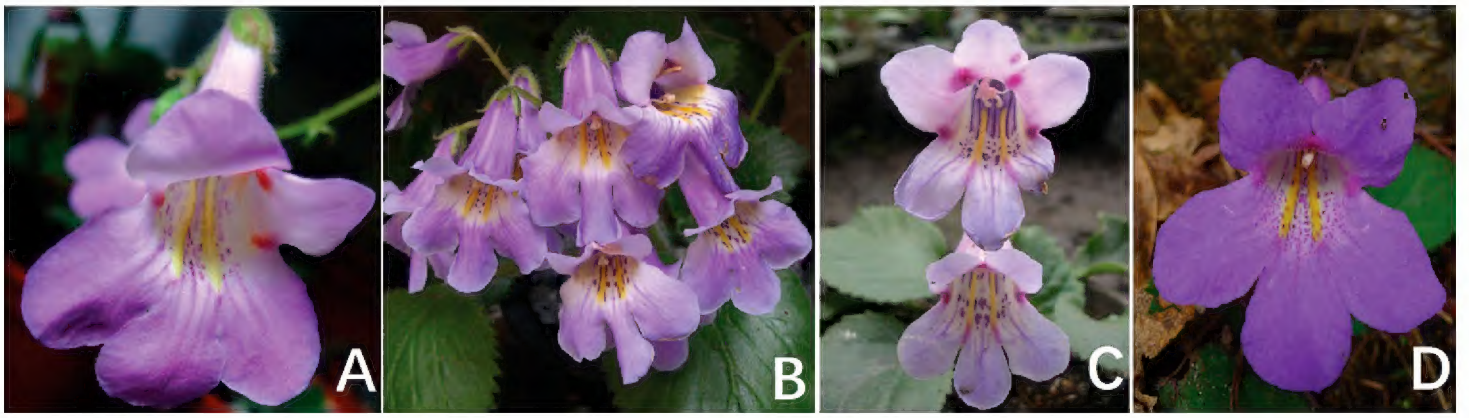

Figure 4. The corolla throat character of *Primulina serrulata*'s congener, *P. fimbrisepala*. **A** from Wenzhou city, Zhejiang **B** from Ziyuan County, Guangxi **C** from Jinxiu County, Guangxi **D** from Ruyuan County, Guangdong. Photoed by Fang Wen, Charted by Wen-Hua Xu.

Table 1. Morphological comparison of *Primulina serrulata* sp. nov. and *P. fimbrisepala*.

Characters	*P. serrulata*	*P. fimbrisepala*
Indumentum of leaf blade	densely erect white multicellular hispid and short hispid on both surfaces	adaxially puberulent and appressed pilose, abaxially sparsely puberulent to velutinous
Indumentum of peduncles	densely erect white multicellular hispid and short hispid	pubescent to appressed pilose
Calyx lobes size	8–15 × 3–5 mm wide	7–11 × 1.5–3.0 mm wide
Corolla color	pale purple to purple, throat without dark purple spots	blue, purple, to pinkish green, throat with numerous dark purple spots
Filaments length	ca. 1.5 cm long	ca. 1.3 cm long
Indumentum of anthers	Glabrescent	sparsely bearded
Stigma size	ca. 1 mm long, ca. 0.8 mm wide	2–3 mm long, ca. 1 mm wide
Flowering time	late April to early May	March to early April

Acknowledgments

This work was supported by grants from the Doctor Foundation of Zunyi Normal College (BS[2018]17), the Science and Technology Bureau of Zunyi City - Zunyi Normal College Foundation Joint Project ([2018]11), the Innovation Ability Promotion Plan of Guizhou Higher School (QJHXTCXZ [2013]11), Science Research Foundation of Guangxi Academy of Sciences (2017YJJ23022), the Key Sci. & Tech. Research and Development Project of Guangxi (Guike AB16380053) and the foundation of Key Laboratory of Plant Resources Conservation and Sustainable Utilization, South China Botanical Garden, Chinese Academy of Sciences and the Fund of Guangxi Key Laboratory of Plant Conservation and Restoration Ecology in Karst Terrain (17-259-23). For editorial assistance, we thank Michael LoFurno (Adjunct Professor, Temple University) and Stephen Maciejewski (The Gesneriad Society, U.S.A) from Philadelphia, USA.

References

Gao Y, Ai B, Kong HH, Kang M, Huang HW (2015) Geographical pattern of isolation and diversification in karst habitat islands: A case study in the *Primulina eburnea* complex. Journal of Biogeography 42(11): 2131–2144. https://doi.org/10.1111/jbi.12576

Hao Z, Kuang YW, Kang M (2015) Untangling the influence of phylogeny, soil and climate on leaf element concentrations in a biodiversity hotspot. Functional Ecology 29(2): 165–176. https://doi.org/10.1111/1365-2435.12344

IUCN (2012) IUCN Red List Categories and Criteria: Version 3.1 (2nd edn). IUCN Species Survival Commission, IUCN, Gland and Cambridge.

Kong HH, Condamine FL, Harris AJ, Chen JL, Pan B, Möller M, Van Sam Hoang VS, Kang M (2017) Both temperature fluctuations and East Asian monsoons have driven plant diversification in the karst ecosystems from southern China. Molecular Ecology 26(22): 6414–6429. https://doi.org/10.1111/mec.14367

Li ZY, Wang YZ (2004) Plants of Gesneriaceae in China. Henan Science and Technology Publishing House, Zhengzhou, 721 pp.

Möller M (2019) Species Discovery in Time: An Example from Gesneriaceae in China. Guangxi Sciences 26(1): 1–16.

Möller M, Wei YG, Wen F, Clark JL, Weber A (2016) You win some you lose some: Updated generic delineations and classification of Gesneriaceae-implications for the family in China. Guihaia 36(1): 44–60.

Wang WT, Pan KY, Li ZY, Weitzman AL, Skog LE (1998) Gesneriaceae. In: Wu ZY, Raven PH (Eds) Flora of China. Vol.18. Science Press, Beijing, & Missouri Botanical Garden Press, St. Louis, 244–401.

Wang J, Ai B, Kong H, Kang M (2017) Speciation history of a species complex of *Primulina eburnea* (Gesneriaceae) from limestone karsts of southern China, a biodiversity hot spot. Evolutionary Applications 00: 1–16. https://doi.org/10.1111/eva.12495

Weber A, Clark JL, Möller M (2013) A new formal classification of Gesneriaceae. Selbyana 31: 68–94.

Wei YG, Wen F, Möller M, Monro A, Zhang Q, Gao Q, Mou HF, Zhong SH, Cui C (2010) Gesneriaceae of South China. Guangxi Science and Technology Publishing House, Nanning, Guangxi, 777 pp.

Wen F, Li S, Xin ZB, Fu LF, Hong X, Cai L, Qin JQ, Pan B, Pan FZ, Wei YG (2019) The Updated Plant List of Gesneriaceae in China under the New Chinese Naming Rules. Guangxi Sciences 26(1): 37–63. [in Chinese]

Xu WB, Guo J, Pan B, Zhang Q, Liu Y (2017) Diversity and distribution of Gesneriaceae in China. Guihaia 37(10): 1219–1226. [in Chinese]

Yang LH, Kong HH, Huang JP, Kang M (2019) Different species or genetically divergent populations? Integrative species delimitation of the *Primulina hochiensis* complex from isolated karst habitats. Molecular Phylogenetics and Evolution 132: 219–231. https://doi.org/10.1016/j.ympev.2018.12.011